MEMBRANE SWITCH COMBINED WITH ELECTROLUMINESCENT LAMP PANEL

TECHNICAL FIELD

The present invention relates to the field of membrane switches that further include an electroluminescent lamp panel to form a combination switch-lamp structure.

BACKGROUND

The term "membrane switch" as used herein refers to electrical switches constructed of at least two panels of plastic film spaced from one another so that a surface of one film faces a surface of the other film. The two facing surfaces each carry a conductive pattern, generally printed with a conductive ink or applied onto the films by vacuum metalizing techniques. The conductive patterns include contacts juxtaposed to form one or more switch cells; the conductive pattern on at least one of the film panels includes conductive tracks leading from the contacts of the pattern to an edge of the film panel for connection to external circuitry. The two panels are spaced from each other by a spacer layer between the two facing surfaces, which can be a patterned adhesive layer or a die-cut plastic film, having apertures positioned between contacts of the conductive pattern on the surface of one film and contacts of the conductive pattern on the facing surface of the other film. A contact on one film and a contact on the other film electrically registered therewith form a switch cell; most membrane switches are made with a plurality of switch cells arranged in rows and columns.

The term "electroluminescent lamp panel" as used herein refers to lamp elements comprising a base electrode spaced from a transparent electrode together with a dielectric layer and a phosphorescent layer between the two electrodes. Two types of electroluminescent lamp panels are known in the art, "foil" and "printed" which differ from one another by the nature of the base electrode. In a foil electroluminescent lamp, the base electrode is a thin aluminum foil layer whereas in a printed electroluminescent lamp the base electrode is a printed layer of conductive ink. Conductive leads extend from the base and transparent electrodes of the lamp panel. When AC voltage is applied across the leads, the current induced between the base and transparent electrodes causes the phosphorescent layer to emit light, a phenomenon known as luminescence. An electroluminescent lamp can be thought of as a light emitting capacitor. The light is visible through the transparent electrode, and various chemicals are known in the art that can be employed for the phosphorescent layer to provide lights of various colors. The lamp panels can include one or a plurality of individual electroluminescent lamps.

Membrane switches find widespread use in installations in which a sealed or protected switch or operating panel is desirable. For example, they are employed in equipment which requires manual data entry such as computer keyboards, terminals, cash registers and the like. Also, membrane switches are widely used as a control or instrument panel for appliances such as washers, microwave ovens, industrial controls, copy machines, and the like, in which finger touch micro-motion actuation is a useful feature.

There are numerous uses of membrane switches in which it is desirable to include lighting as part of the switch panel. The lighting may be used for general background lighting of the membrane switch panel or it may be used to provide a visual indication when a particular switch cell of a membrane switch panel is activated. Electroluminescent lamp panels are a useful source of light for use in combination with a membrane switch panel since they can provide attractive, effective lighting in various colors and they can include individual or discrete lamp segments.

The typical structures disclosed in prior patents that combine an electroluminescent light panel and membrane switch layers generally provide for lamp panels that are separate from the membrane switch elements, most often in a layered construction in which the lamp panel is placed above or superimposed upon the membrane switch elements. In particular, this type of construction is disclosed in U.S. Pat. Nos. 4,060,703, 4,320,268 and 4,532,395. Another feature of the prior art constructions illustrated in these patents is that the leads associated with the electroluminescent lamp panels are independent of leads associated with the membrane switch elements. It is my belief that the prior art constructions are cumbersome and expensive to manufacture; accordingly, one of the principal objects of my present invention is to provide a cost effective system for combining a membrane switch and an electroluminescent light panel in a composite assembly. Another main object is to provide a membrane switch-electroluminescent lamp panel assembly in which circuitry for both the switch and the lamp panel can be arranged to lead onto a single tail of the assembly for connection to external circuitry. Another main object is to provide a membrane switch-electroluminescent light panel assembly in which leads to the switch and leads to the lamp panel can be on separate tails if so desired, and still provide a convenient system for accommodating the electrical leads to the two elements of the assembly. Other objects of this invention will become apparent from the detailed description which follows.

SUMMARY OF THE INVENTION

The present invention provides a new combination of a membrane switch and an electroluminescent lamp panel in which (1) the membrane switch includes spaced circuit layers with conductive circuits on facing surfaces thereof and at least one tail portion, (2) the electroluminescent lamp panel has conductive leads along at least one surface thereof, and (3) the lamp panel is attached to at least one of the circuit layers of the membrane switch with the conductive leads thereof electrically connected to conductive pads on the circuit layer.

DESCRIPTION OF THE DRAWINGS

The present invention is fully described hereinafter by reference to the accompanying drawings, in which:

FIG. **1** is a plan view of an electroluminescent lamp panel of the type employed with the assembly of the present invention illustrated in an intermediate stage of its manufacture;

FIG. **2** is a plan view of the lamp panel of FIG. **1** in its completed form;

FIG. **3** is a sectional view of the lamp panel as illustrated in FIG. **2**;

FIG. **4** is an exploded view of a membrane switch-electroluminescent lamp panel assembly of the present invention;